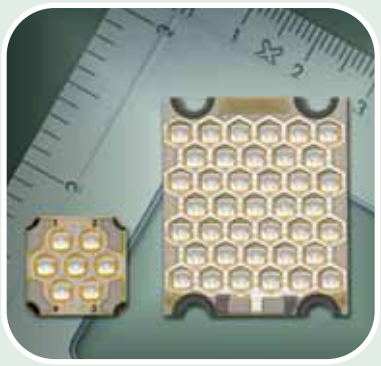
lamina®
Bright Lights. Bright Ideas. ™

Connection Guide for Lamina LED Light Engines



Lamina's light engines utilize a unique packaging solution developed for the high power semiconductor industry. The utilization of this packaging solution in the high brightness solid state lighting industry is revolutionary in the brightness and the light density that can be achieved, but requires some skill in connecting to the fixture electrical circuitry and assembly to the heatsink. This application note addresses the methodology for solder attachment of the light engine to electrical circuitry and mechanical attachment of the light engine to the heatsink.

INTRODUCTION

Solid state lighting, in the form of LEDs, is projected to rapidly replace Incandescent light sources in many applications. Unlike traditional "lamp" type devices, where circuits are connected to a socket and the lamp is screwed or pushed into the socket, solid state lighting requires circuit attachment directly to the light engine (source). In addition, this light engine requires attachment to a heatsink to remove conducted heat generated in the semiconducting body. Lamina's light engines are designed for compatibility with standard hand soldering and reflow soldering profiles.

LIGHT ENGINE DESCRIPTIONS

Lamina's light engines are manufactured using solderable electrical connectors. The solderable material is a leach resistant Silver Palladium material designed to accept 235 C solder materials.

The BL-1000 product is designed as a true Surface Mount device for attachment to printed circuit boards using SMT (surface mount technology) processes. The interconnects are on the bottom of the package and a reflow soldering process is required to make connection to the printed circuit board. The BL-1000 package is compatible with standard 235 C solder reflow processes and typical circuit board material ranges from traditional FR4 using plated thermal vias to the new MCPCB (Metal Clad Printed Circuit Boards) such as those manufactured by Bergquist.

The BL-2000 device is capable of either hand soldering using a soldering iron and typical electronic grade solder and flux. This product is also capable of utilizing reflow soldering processes in a standard 235 C process.

The BL-3000 light engine is designed to solder primarily by hand using the same process as the BL-2000.

HAND SOLDERING LIGHT ENGINES (Applicable to BL-2000 and BL-3000)

Required Materials:

1) Temperature Controlled soldering iron
2) Wire core solder with RMA flux, Sn62/Pb36/Ag2 or Sn96.5/Ag3.5 Lead Free
3) 18 - 22 AWG, stranded copper wire
4) RMA Flux

Lamina Super-Bright LED Arrays

As the market leader in the development and manufacture of super-bright LED arrays, Lamina brings solid state lighting to applications which until now were only possible with traditional lighting sources. Lamina's standard products, available in white, RGB and monochrome, are designed to deliver up to 100W of super-bright light. In addition, Lamina provides customized LED arrays and package configurations. Applications include architectural lighting, general illumination, automotive, signage, and signaling.

Lamina LED arrays are manufactured by combining high brightness LEDs from industry-leading LED manufacturers with Lamina's proprietary packaging technology, multilayer Low Temperature Co-Fired Ceramic on Metal (LTCC-M). LTCC-M is a breakthrough in thermal performance for LED packaging technology, a key factor in determining LED life and reliability. Unmatched thermal performance coupled with package interconnectivity allows Lamina to densely cluster multiple LEDs to achieve exceptionally high luminous intensity in very small footprints.

lamina®
Bright Lights. Bright Ideas. ™

Preparation:

1) Cut and Strip wire to desired length

2) Assure solder iron temperature does not exceed 750ºC

3) Pre-tin wire by heating with the soldering iron and applying solder to a thin/uniform thickness

4) Clean terminals on Lamina's BL-2000 or BL-3000

a. If the terminal is heavily oxidized due to improper storage, rubbing with a "pink" pencil erasure may be necessary. This gentle rubbing action is very effective in removing oxides from Ag/Pd surfaces

b. Use a solvent such as IPA (Isopropyl Alcohol) to remove non-polar compounds

5) Tin the Light Engine terminals by

a. First applying a small amount of flux (with a swab or brush) onto the terminal surface

b. Hold the solder iron tip against the terminal and allow terminal to heat up to solder flow temperature (approx. 180 ºC)

c. Apply solder to the tip and terminal, allowing the solder sufficient time to wet out against the Ag/Pd terminal area. The solder should form a dome shape over the terminal

d. Allow parts to cool, and clean to remove residual solder flux

i. Cleaning is achieved by brushing IPA over the surface and allowing the IPA to dry.

6) After terminals have been tinned and cooled, attach the light engine into your fixture (see section below on attachment methods)

7) When light engine is firmly attached to the fixture, re-apply the hot solder iron tip to the solder dome on the light engine terminal. As soon as solder becomes liquid (around 180 C), insert the pre-tinned wire into the molten solder, holding the wire in place, carefully remove the solder iron tip and allow solder to cool. Do not exceed more that 30 seconds of heat application to the terminal or leaching of the Ag/Pd could occur.

A final cleaning may be required using IPA with a brush or swab to remove any debris that still resides on the surface Take extra caution during these cleaning steps.

REFLOW SOLDERING LIGHT ENGINES (Applicable for BL-1000 and BL-2000)

Two basic methods can be incorporated for reflow soldering processes. The first technique described will be for prototype and small volume assemblies. The second technique is for high volume production level assembly.

Reflow soldering Light Engines is typically utilized for attaching the solderable terminals to a printed circuit board of FR4, Flex Board or MCPCB (Metal Clad Printed Circuit Board). Reflow processes can also be used to attach leads, wiring harnesses or similar peripheral items. This section will cover the reflow process onto traditional PCB's. The materials and processes are generally the same for all reflow operations, with the primary difference being in the reflow oven profile.

SINGLE OR SMALL VOLUME ASSEMBLY

Materials Needed:

1) Temperature controlled hot-plate with 250ºC max capability

2) Hot Air Gun capable of achieving air temperature greater than 300 ºC, with controllable airflow.

3) Solder Paste with RMA flux, Sn62/Pb36/Ag2 or Sn96.5/Ag3.5 Lead Free

4) Circuit Board with recommend solderpad layout (available from Lamina)

5) IPA (Isopropyl Alcohol), or cleaning agent designed for solder paste used.

6) Pressurized pneumatic solder paste dispenser or screen-printing capability depending upon desired method.

Preparation:

1) Using a pneumatic dispenser, and appropriately selected needle tip, deposit sufficient solder paste to completely cover the PCB solder pad

2) If using Screen or stencil print, set up according to solder paste recommendations

3) Using tweezers, or an SMT placement system, place Light Engine with correct orientation onto the solder pads

4) Exert slight pressure to push the light engine gently into the paste

5) Carefully place the PCB with the mounted light engine on the hotplate set to a minimum of 170 C (Maximum of 235 C)

6) Allow part to heat to hotplate temperature (approx 2-3 minutes). The flux in the solder paste will begin to activate the surface preparing it for the solder adhesion.

7) Using the hot air gun, gently continue to heat the part residing on the hotplate, until the solder becomes liquid (at approx. 185 ºC). The part will begin to float and should self center over the solder pads due to surface tension of the solder.

8) Continue to heat for 30 seconds to allow for temperature to stabilize.

9) CAREFULLY, with tweezers, remove the PCB, with the light engine now in molten solder from the hotplate.

10) Allow the assembly to cool to room temperature and gently clean with IPA to remove residual solder flux.

lamina®
Bright Lights. Bright Ideas. ™

HIGH VOLUME SMT MOUNTING PROCESSES

Equipment Needed:

1) High Volume SMT assembly line
   a. SMT Solder Paste Screen Printer or Dispenser
   b. SMT Pick and Place machine
   c. IR Reflow over sized to meet total thermal load needs of the production
   d. Cleaning station

2) Solder Paste with RMA flux, Sn62/Pb36/Ag2 or Sn96.5/Ag3.5 Lead Free

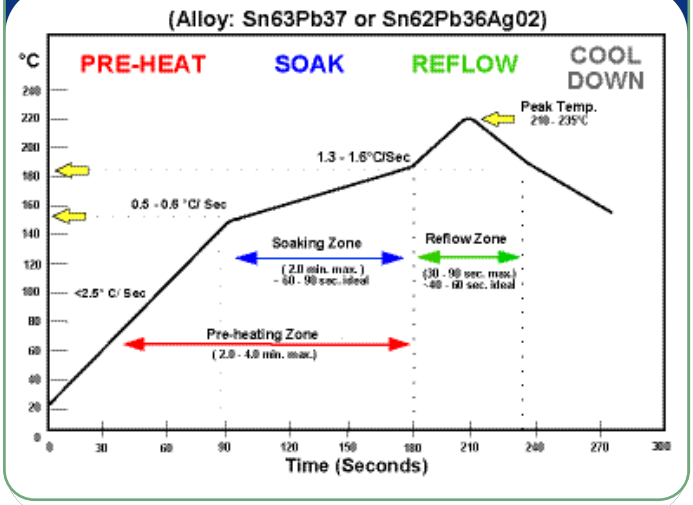
3) Circuit Board with recommend solderpad layout (available from Lamina)

Preparation:

Using SMT assembly techniques (not covered in this application note) prepare and assemble light engines onto the printed circuit boards. Reflow solder using a solder that DOES NOT exceed 260 C molten temperature. Allow part to cool. Clean part in a manner prescribed by the solder past supplier, and singulate.

A "typical" solder reflow profile used on Lamina's light engines is shown in *Figure 1.*

Figure 1. No-Clean Solder Paste Reflow Profile



Kester Reflow Profile

Attaching connectors to the PCB or driver circuitry can be done in the same reflow step as the light engine assembly, unless both sides of the circuit board are to be populated. Consult with Lamina's technical department for guidance with these assemblies.

Attachment of leadwires to the PCB is completed in the same manner as the hand soldering process described above.

CONDUCTIVE EPOXY ATTACHMENT

It is possible to also attach Lamina's light engines to PCB sources using Conductive Epoxies. As there are a great number of conductive epoxies available, each with differing material properties, it is recommended to follow guidelines established by the adhesive supplier for assembly.

Most conductive epoxies cure to a high modulus. With Lamina's Light Engines CTE of 5.8 ppm/ ºC, and PCB material having CTE of 12 (FR4) to 18 (MCPCB) there is a chance of mechanical stresses exceeding either the adhesive or cohesive yield point of these materials, leading to electrical circuit open, or intermittent signal loss. Please do not hesitate to contact Lamina's Technical Department for assistance.

Curing of epoxies is generally dependent upon a time/temperature relationship. Lamina's light engines are designed to withstand brief thermal excursions up to 260ºC. Please follow the recommendations of the epoxy supplier to determine the cure schedule that suits your process.

CONNECTION TO HEATSINKS

Lamina's light engines are designed to provide very low thermal resistance from die junction to case. Proper attachment of the light engine to the heat sink is necessary for optimal thermal management and to yield the highest performance and reliability. Please reference Lamina's application note on Thermal Management for assistance and material selection.

Lamina's light engines are provided with Flange Mount features to enable the optimum connection to a heatsink. Heatsinks should be drilled and tapped to configurations specified on the Light Engine datasheet.

Other attachment techniques (other than flange mounting) can be employed however it must be taken into consideration that thermal resistance will increase or mechanical integrity may be compromised. These parameters have a dramatic impact on the total thermal resistance of the entire light system, which affects both light output and lumen maintenance. Please contact Lamina's Application Engineering for support in this area, or refer to our application note on Thermal Management.

.

lamina®
Bright Lights. Bright Ideas. ™

MATERIAL SUPPLIERS, INDUSTRY LINKS

This section is not intended to be a comprehensive list of all known material suppliers. There are numerous suppliers of these products and the user should determine suitability or viability of these suppliers and their products.

Solder Products:

Kester	www.kester.com
Aim	www.aimsolder.com
Loctite/Multicore	www.multicore.com

Chemicals:

Chemtronics	www.chemtronics.com
Techspray	www.techspray.com

Equipment / General Supplies:

Techni-Tool	www.techni-tool.com
Metcal	www.metcal.com
Weller	www.coopertools.com
Hakko	www.hakko.com

Note: Lamina does not specifically endorse the listed third party companies or their products or services, is not affiliated with such companies, and shall not be held liable for any reason as a result of providing this information.

HANDLING PRECAUTIONS

Contact with the silicone based encapsulant on the surface of the light engine must be avoided to prevent damage. Do not apply pressure to the silicone based encapsulant or allow it to come into contact with sharp objects. Lamina LED arrays must be handled from the sides.

ESD PROTECTION

LEDs are static sensitive and susceptible to electrostatic discharge (ESD) damage. Lamina LED arrays must be handled using ESD damage control precautions.

Lamina Ceramics
120 Hancock Lane
Westampton, NJ 08060
1-800-808-5822
1-609-265-1401